Vegetation/Ecosystem Modeling and Analysis Project (VEMAP)

Lessons Learned
or
How to Do It Right; How to Get What You Need

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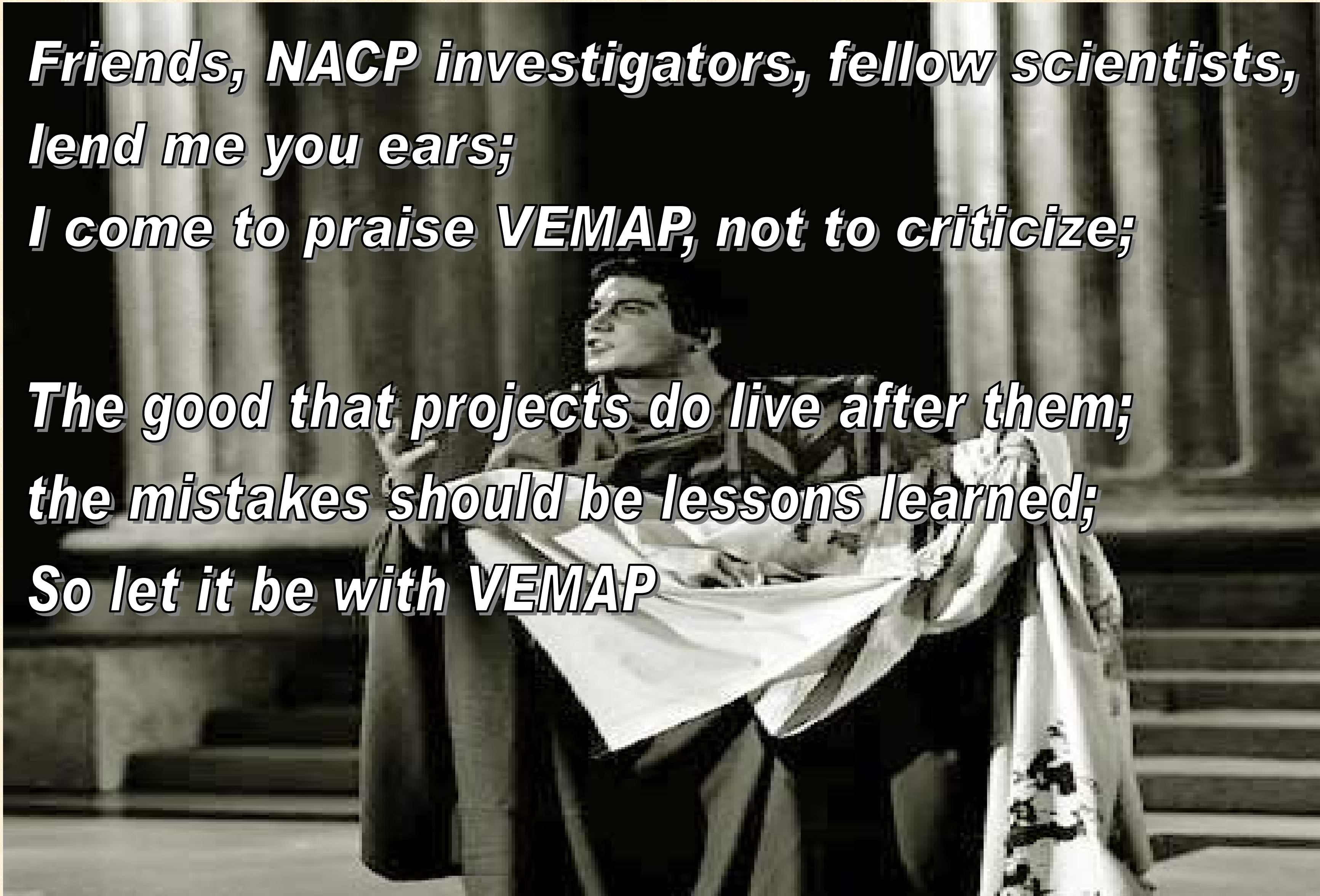
NACP Data Management Planning Workshop
January 25-27 2005
New Orleans, LA

Where I'm coming from...

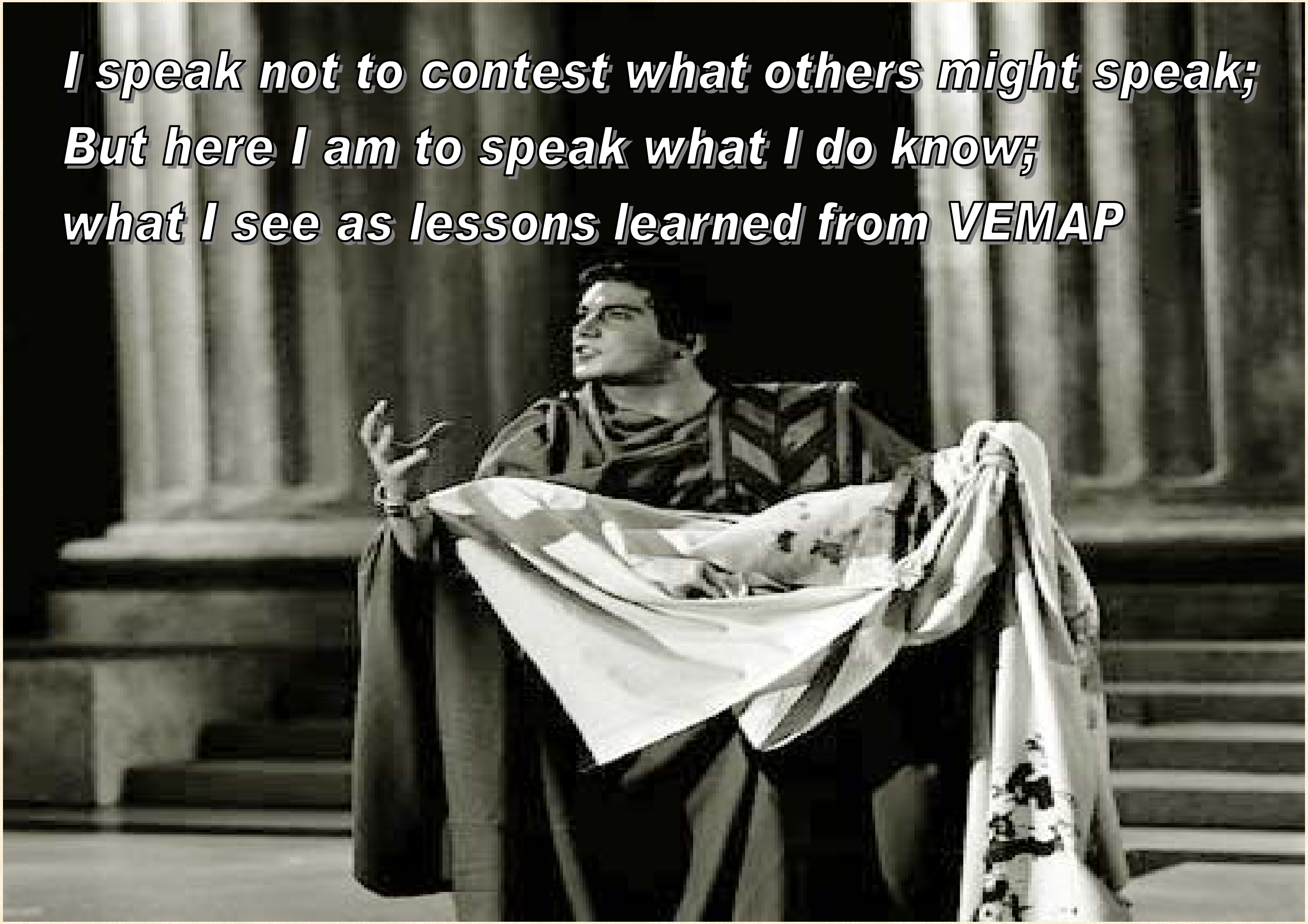
- I'm speaking ***from*** VEMAP or ***of*** VEMAP not ***for*** VEMAP

- I come to praise Caesar, not to bury him.


Friends, NACP investigators, fellow scientists,
lend me you ears;
I come to praise VEMAP, not to criticize;
The good that projects do live after them;
the mistakes should be lessons learned;
So let it be with VEMAP

Outline

- An overview of VEMAP
- A few VEMAP findings
- Lessons learned relevant to NACP data management
  - Good
  - Not so good
- Summary/Conclusions


I speak not to contest what others might speak;
But here I am to speak what I do know;
what I see as lessons learned from VEMAP

Overview of VEMAP

- The Vegetation-Ecosystem Modeling and Analysis Project (VEMAP) was a large, collaborative, international, multi-agency effort to simulate and understand ecosystem dynamics for the conterminous United States.
- VEMAP objectives were to intercompare biogeochemistry and biogeography models and determine their sensitivity to changing climate and elevated atmospheric CO_2 concentrations.
- An intermodel comparison, with explicit and structured control for differences in model inputs.

Overview of VEMAP

"To accomplish [VEMAP] objectives, the models require common boundary conditions and driving variables so that differences in model results arise only from the models and their implementation rather than from differences in inputs."

(p. 858, Kittel et al., 1995, *J. Biogeography* 22)

Overview of VEMAP: VEMAP had two phases

- **Phase 1 (VEMAP 1)** was structured as a sensitivity analysis, with factorial combinations of climate (current and projected under doubled CO_2), atmospheric CO_2, and mapped and model-generated vegetation distributions.

- **Phase 2 (VEMAP 2)** compared time-dependent ecological responses of biogeochemical models and coupled biogeochemical-biogeographical models to historical and projected transient forcings (time-series) of climate and CO_2.

VEMAP Datasets

- A *lot* of effort and resources led by Tim Kittel and Dave Schimel and the VEMAP data group at NCAR went into the creation and QA of the common model inputs.
- VEMAP 1 database is gridded (0.5º) data layers of bioclimate, climate change scenarios, soil properties, and potential natural vegetation. The set has both daily and monthly, physically consistent, representations of the same long-term climate.
- VEMAP 2 database added a historical (1895-1994) gridded dataset of climate and transient climate change scenarios based on coupled atmosphere-ocean GCM experiments.

VEMAP findings

- Strong forcing of one or a few processes does not necessarily result in large changes in ecosystem carbon because of constraints from other limiting resources (e.g., N or PAR).
- Variation among models was “relatively modest”; the variation present was linked to differential sensitivities of hydrologic and nitrogen cycles to increases in temperature and CO_2.
- **Understanding, modeling and predicting changes in carbon require understanding and modeling of integrated carbon, nitrogen and water cycles.**

VEMAP findings

- Models were sensitive to disturbance; knowledge of spatial and temporal patterns of disturbance and ecosystem response to is needed for spatial modeling of ecosystems.
- Models simulated a smaller sink than estimated by inversions, highlighting the important role of forest regrowth in a North American carbon sink.
- **Spatially extended terrestrial ecosystem models must incorporate spatial patterns of disturbance and recovery from disturbance.**
- Intermodel variability was higher at the regional scale than for the entire continent.

Lessons Learned

"To accomplish [VEMAP] ***objectives***, the models require common boundary conditions and driving variables so that differences in model results arise only from the models and their implementation rather than from differences in inputs."

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Lessons learned: model requirements strongly guided data requirements

[The model intercomparison required] “physical consistency among driving variables and boundary conditions…that did not violate the conceptual basis of any of the models.”

“matching model requirements was…a key constraint in the development of consistent…data sets.”

“Matching model requirements…played a role in the classification of vegetation types”.

Lessons learned: Good

- **Explicit objectives** or goals measured by tangible products generate specific requirements that in turn provide the required specifications and constraints for the data systems.
- **Assumptions** in the data and data processing **need to be made explicit** and transparent to the user.
- Need to establish and follow a clear **protocol for QA**

Lessons learned: Good

- A **dissemination plan** with considerations of version control, metadata and distribution strategy is required.
- Need to create **essential user tools** but just the essentials; avoid the distraction of super-tools or toolboxes.

Lessons learned: Good

- It takes **resources**, money, people, infrastructure and time to meet the data system specifications and requirements.

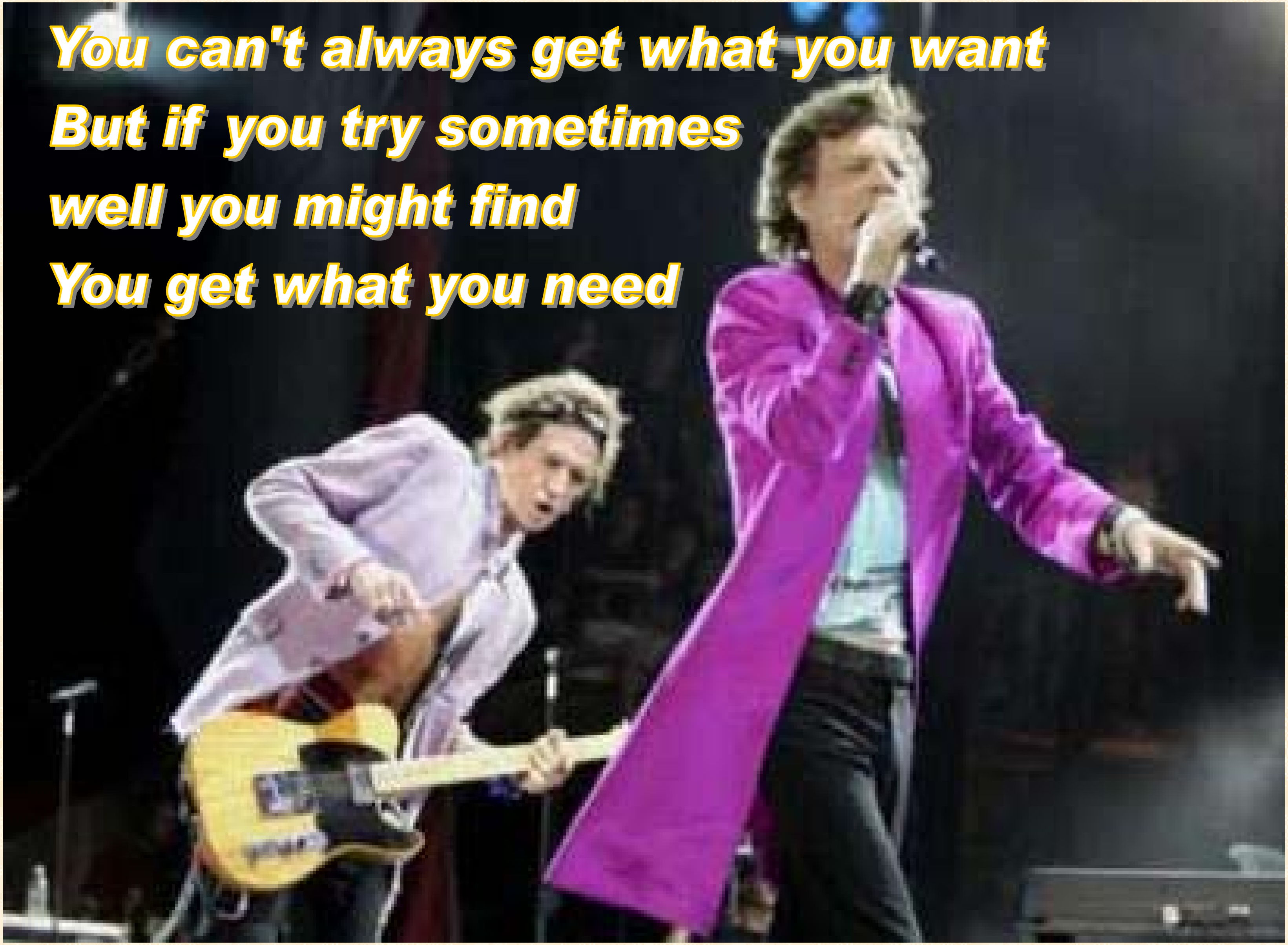
- It requires close, real **integration and dialogue** between the modeling and data systems to both define and realize requirements.

Lessons learned: not so good

- Comparisons against experimental data are needed leading to **model-data intercomparisons rather than just model intercomparisons.**
- **More common biological/ecologial parameterization**, not just common forcings and boundary conditions, are needed.
- More attention to **uncertainty analysis** and error propagation.

Summary/Conclusions

- VEMAP was a success, both as a model intercomparison, and, inextricably, as a data system.
- VEMAP is a model for NACP data systems.
- NACP data systems should include data for model testing, process parameterization and provide for formal uncertainty analysis.
- Resources are required.
- Explicit program objectives/deliverables similar to project objectives are needed to provide the necessary specifications for a NACP data system.


You can't always get what you want
But if you try sometimes
well you might find
You get what you need